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Technology bank and science, technology and innovation supporting mechanism dedicated to the least developed countries

Report of the Secretary-General

Summary

The present report is submitted pursuant to General Assembly resolution A/67/220, whereby the Secretary-General was requested, inter alia, to take the steps necessary to undertake a joint gap and capacity analysis on a priority basis by 2013 with the aim of establishing a technology bank and science, technology and innovation supporting mechanism dedicated to the least developed countries, building on existing international initiatives.

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I. Introduction

1. The Programme of Action for the Least Developed Countries for the Decade 2011-2020 (Istanbul Programme of Action) and the Istanbul Declaration, which were adopted in 2011 at the Fourth United Nations Conference on the Least Developed Countries, called for undertaking on a priority basis by 2013 a joint gap and capacity analysis with the aim of establishing a technology bank and a science, technology and innovation supporting mechanism dedicated to the least developed countries. In this connection, the Istanbul Declaration welcomed the generous offer of the Government of Turkey to host an International Science, Technology and Innovation Centre.

2. The Economic and Social Council, in its resolution 2012/26, reaffirmed the mandate of the Istanbul Programme of Action in this regard.

3. The General Assembly, in paragraph 21 of its resolution A/67/220, requested the Secretary-General to take the steps necessary to undertake a joint gap and capacity analysis on a priority basis by 2013, with the aim of establishing a technology bank and science, technology and innovation supporting mechanism dedicated to the least developed countries, building on existing international initiatives. The present report has been prepared pursuant to that resolution.[1]

4. The Istanbul Programme of Action envisaged the technology bank and science, technology and innovation supporting mechanism dedicated to the least developed countries as a means that would help improve their scientific research and innovation base, promote networking among researchers and research institutions, help them access and utilize critical technologies, and draw together bilateral initiatives and support by multilateral institutions and the private sector, building on existing international initiatives. The present report argues that a comprehensive and integrated approach is needed to respond effectively to the mandate of the Istanbul Programme of Action in this regard. It is thus proposed that the technology bank comprise: (a) a patents bank to help the least developed countries access and utilize appropriate technologies; (b) a science, technology and innovation supporting mechanism to help improve the scientific research and innovation base of the least developed countries; and (c) a science and technology research depository facility to promote global networking of researchers and research institutions in the least developed countries. Strong global support will be key to the success of the technology bank.

5. The present report outlines the rationale and broad functions of the technology bank but does not attempt to provide a blueprint of specific institutional arrangements. It recommends that further consultations, serviced by the Office of the High Representative, should be undertaken to define its structure, functions, governance mechanism, funding and staffing arrangements and other institutional matters. Such consultations should involve a pool of experts drawn from the host

[1] The Office of the High Representative for the Least Developed Countries, Landlocked Developing Countries and Small Island Developing States has organized a task force comprising relevant organizations of the United Nations system and the host country to follow up on the mandates of the Istanbul Programme of Action, the Economic and Social Council and the General Assembly in this regard. The Office of the High Representative also organized a special event on this subject during the regular session of the Economic and Social Council in 2013. It also launched a substantive study, which provided inputs to the present report.

country, the least developed countries and their partner countries, agencies of the United Nations system and other relevant stakeholders, in order to work out institutional modalities.

II. Overview of the science, technology and innovation capacity gap of the least developed countries

6. The Istanbul Programme of Action established the aim of enabling half the least developed countries to meet the criteria for graduation by 2020 (see A/CONF.219/3/Rev.1, para. 28). Achievement of that ambitious goal would require structural transformation, including through technological leapfrogging by least developed countries. However, building endogenous science and technology capacities of a high standard takes many years.[2] Thus, the compressed graduation timeline of the Istanbul Programme of Action suggests an even steeper learning curve if science and technology is to fulfil its potential of equipping the least developed countries with the means to develop their economic base on a firm footing and better compete in the wider global economy.

7. No country has been able to embark on rapid economic growth without technological change. It could take many decades for the least developed countries to overcome their structural constraints unless they are able to substantially strengthen their science, technology and innovation base and capacity. Thus, technological transformation holds the key to the accelerated growth and development of the least developed countries and, in the process, their graduation from that category. The design and purpose of the technology bank must be structured to best help meet this formidable challenge of technological leapfrogging by the least developed countries.[3]

8. The state of science, technology and innovation in the least developed countries remains poor. Research and development expenditure as a percentage of gross domestic product (GDP) for 2011 stood nearly at nil in the majority of those countries. The disparities between the least developed countries and the rest of the world in the capacity to generate and apply scientific and technological knowledge have been growing. While members of the Organization for Economic Cooperation and Development spent on average 2.3 per cent of GDP on research and development in 2010, the amount dedicated to research and development in the least developed countries, where data is available, was negligible.[4] Limited resources, including a narrow base of science literacy, contributed to scant generation, diffusion and application of scientific knowledge in the least developed countries. Similarly, the limited endogenous research and development capabilities in those

[2] The late Argentine physicist Jorge Sabato observed that it takes about 15 years to build a world-class research institute capable of generating its own scientific breakthroughs. Cited by the Global Knowledge Initiative; see www.globalknowledgeinitiative.org/about-us/index.html.

[3] See the report of the Secretary-General on options for a facilitation mechanism that promotes the development, transfer and dissemination of clean and environmentally sound technologies (A/67/348).

[4] For instance, Burkina Faso spent 0.20 per cent of GDP on research and development in 2009; Ethiopia, 0.24 per cent in 2010; Gambia, 0.016 per cent in 2009; Lesotho, 0.029 per cent in 2009; Madagascar, 0.14 per cent in 2009; and Uganda, 0.41 per cent in 2009.

countries render them dependent on the acquisition of new technologies from abroad.

9. Conversely, a number of developing countries with fast growing economies have in recent years made substantial investments in science and technology and related research and development. In so doing, they have also challenged the global science and technology/research and development triad of Japan, North America and Western Europe. The United Nations Educational, Scientific and Cultural Organization (UNESCO), in its *Science Report 2010*, noted the dramatic increase of investments in science and technology by leading nations in the developing world and their positive impact on global economic growth, while observing that, "by contrast, the group of least developed countries ... still plays a marginal role".[5]

10. An illustrative way to depict science, technology and innovation in the least developed countries is perhaps to look at the number of articles published in scientific and technical journals by those countries. Using data from the Institute for Scientific Information's Science Citation Index and Social Sciences Citation Index, all of the least developed countries combined published 1,398 scientific and technical journal articles in 2009, up from 874 in 2001. This meagre production contrasts starkly with what is happening in other countries.[6] Today, some 20 per cent of all science articles published in peer reviewed international journals are authored by researchers in the developing world. Although encouraging, those statistics disguise the lopsided influence of five countries (Brazil, China, India, Mexico and Turkey), whose scholars contribute over half of the South's science publications.

11. The total number worldwide of scientific and technical articles published in journals in 2009 was 788,333, 0.0018 per cent of which contributions were from the least developed countries. The least developed countries, with around 12 per cent of the world population, produced an almost imperceptible share of scientific and technical articles, while the United States, with roughly 4.5 per cent of the world population, produced 26.5 per cent of all scientific and technical papers. In addition, it seems that differences are becoming more accentuated as the number of articles published seems to be growing faster in other developing countries than in the least developed countries.

12. The low number of patents filed by residents of the least developed countries in their own countries and abroad provides another dismal scenario. Residents of least developed countries filed 176 applications in 2011, down from 293 in 2001. The average number of applications filed for the period 2001-2011 amounted to 302 — quite meagre compared with other countries. For instance, in 2011, Romania filed 1,597, Kazakhstan 1,821, Belarus 2,368, India 15,717, Turkey 5,265, Mexico 1,863 and Malaysia 1,927.

13. It is important to note that there are many provisions governing the transfer of technology in international agreements, conventions and protocols. However, the existing arrangements and mechanisms for the transfer of technology have not been

[5] See United Nations Educational, Scientific and Cultural Organization, *Science Report 2010: The Current Status of Science around the World*, p. 5. UNESCO reviews the state of global science every five years.

[6] For instance, in 2009, Argentina published 3,655 scientific articles, India 19,917, the United States of America 208,600 and Canada 29,016.

able to benefit the least developed countries in a meaningful way in building their technological base. Various studies suggest that the existing mechanisms for technology transfer are fragmented and often ad hoc in terms of objective, content and country coverage. There is no global framework, agreement, or mechanism that is comprehensive and all-encompassing for scientific and technological capacity-building in the least developed countries. Those constraints are discussed below.

14. Substantial investments of time, effort and money are required to build the capacity of indigenous science, technology and innovation and integrate that capacity into productive activities in order to drive greater and more rapid economic growth. As noted above, building a research institution of international standard requires longer-term investments that stretch over a decade and a half or more. Over that period, considerable effort must go into attracting human resources of the highest quality, building cutting edge facilities, procuring essential equipment, developing relationships with universities, firms and markets globally, and securing online connectivity to ensure that researchers can readily interact with their peers globally and access current, online publications.[7] This developmental model, of course, assumes the existence of institutional capacity and funding commensurate to the achievement of such an ambitious goal.

15. The chronic underdevelopment of research and development systems in the least developed countries makes the adaptation and absorption of existing technologies necessary, especially in the early stages of industrial upgrading. In fact, many newly industrialized countries started adapting technologies from abroad to their own nascent industrial base before being able to generate their own scientific and technical knowledge. Absorptive capacities require a certain degree of internal technological expertise to be able to assimilate external knowledge and integrate it into a local context.

16. Imports and foreign direct investment are among the major channels of technology transmission. The structural constraints on the balance of payments of the least developed countries, and thus their severely restricted ability to import, have dampened the transfer of technology to the least developed countries. Their marginalization in global flows of foreign direct investment further reinforces the lack of transmission of technology. Furthermore, the limited capacity of the least developed countries to integrate foreign technology into their particular circumstances reduces their ability to realize the full potential of such technology. Strengthening the innovation capacities of the least developed countries to foster the adaptation and absorption of foreign technology could greatly accelerate the development of their productive capacities through the adaptation and absorption of technology, in addition to fostering endogenous research and development. This is the crux of the problem in the least developed countries.

17. The underlying premise of a technology bank is that there are complementary facets of the same science and technology ecosystem. As such, they should work in tandem and mutually reinforce one another. In addition, they require high-bandwidth Internet connectivity, both to advance research and to enable researchers in the least developed countries to participate in the worldwide scientific collaboration that characterizes science, technology and innovation today. Concomitantly, science, technology and innovation in this context presupposes that

[7] As observed by the Global Knowledge Initiative (www.globalknowledgeinitiative.org).

its practitioners in the least developed countries will seek to harness science and technology to solve practical problems. Where this might involve the application of patented science or technology, practitioners in least developed countries need an efficient gateway to access relevant intellectual property on affordable or concessionary terms, with credible policies and mechanisms to implement the intellectual property thus transferred. Likewise, when rights holders in the least developed countries[8] generate new or added value of their own, they should have the means and advice on how to derive due benefit from such intellectual property.

18. At the most fundamental level, this implies applied science. A supporting mechanism should help commercialize science and technology where research conducted in the least developed countries develops new science or adds value to existing technologies. This is not to suggest that basic science is not a worthy goal in and of itself; but the economies of most of the least developed countries can hardly afford science if they cannot apply it. Building science, technology, engineering and mathematical capacities for practical use requires deep and long-term investments at both the secondary and tertiary levels.

19. As an adjunct to applied science, a supporting mechanism should offer fundamental training in entrepreneurship and marketing, since most technical researchers cannot be expected to innately display parallel business skills. Moreover, given the inherently weak bargaining position of practitioners in the least developed countries, a supporting mechanism should provide direct marketing and patent assistance to them when they engage with counterparts from countries with more advanced economies. Finally, a science, technology and innovation supporting mechanism should seek investment capital and donor funding to help take to market the most promising science and technology/research and development generated by the least developed countries.

III. Outlook for a science, technology and innovation mechanism for the least developed countries

20. While the creation of a science, technology and innovation mechanism has long appeared to be a daunting task, key advances over the past decade should facilitate such an undertaking now. Some of those developments are:

- The establishment of a successful public-private partnership, namely, Research4Life, which has already embedded a robust and comprehensive technology bank among four United Nations specialized agencies that could be expeditiously expanded across the wider family of multilateral development and technical organizations.
- The laying of undersea fibre-optic cables around Africa, to the Americas and to South and Southeast Asia, affording underserved countries access to global

[8] Rights holders are individuals or groups who hold patents, copyrights, trademarks or geographic indicators. Under the World Trade Organization, the latter category has emerged as protected intellectual property. Currently, for instance, coffee growers in Ethiopia are seeking a "geographic indication" for their highly regarded coffee beans so that they can recapture the price premium currently claimed by foreign coffee brokers. Other least developed countries, such as Rwanda, are employing scientific research to raise the bar for their coffee beans, which are already of top quality.

science and technology collaboration that their world class scientists previously could obtain only by moving abroad.[9]

- Multilateral agencies and civil society are helping the least developed countries overcome traditional intellectual property barriers and demonstrating to them how the intellectual property rights regime can be used to their advantage.
- Contemporary global initiatives, including those in the areas of health, food security and agriculture, water, climate change, sustainable energy and gender, offer multiple intersecting points of synergy for a science, technology and innovation mechanism dedicated to the least developed countries.
- Bilateral and international donor agencies and global funds are putting greater emphasis on science, technology and innovation.
- The emergence of South-South and triangular cooperation, which enables the least developed countries to learn from emerging economies that have already recognized the nexus of science and technology, structural transformation and global trade.
- There is expanded geographical interest from global investors to span "frontier emerging markets", which increasingly encompass the least developed countries.
- Recently established worldwide non-governmental organizations, which are focusing on science, technology and innovation as a generator of economic growth, could prove to be vital partners to the establishment of a science, technology and innovation mechanism for the least developed countries.

21. Notwithstanding the implications of recent economic crises for development cooperation in general, those developments should contribute to a positive outlook for the establishment of a technology bank and a science, technology and innovation supporting mechanism for the least developed countries.

IV. Technology bank for the least developed countries

22. Technological leapfrogging of the least developed countries warrants the speedy bridging of their technology gaps through: (a) the development of an endogenous science, technology and innovation knowledge base and capacity; and (b) the transfer and diffusion of appropriate technologies. This, in turn, requires that attention is paid simultaneously to three interrelated goals: first, the facilitation of technology transfer; second, the promotion of robust, endogenous science, technology and innovation capacity-building; and third, the mobilization of strong global support.

23. The development of endogenous science, technology and innovation capacity includes two main elements: (a) the building of effective national science, technology and innovation policies and institutions; and (b) the substantial

[9] Many scientific luminaries of the South have worked in the North and continue to do so because, as Professor Abdus Salam, the late Pakistani Nobel Laureate (Physics), once told an interviewer (*New Scientist* magazine, 26 August 1976), they seldom find scientists within the same discipline in their home countries with whom they can collaborate. The scientific diaspora from the least developed countries is discussed below in the present report.

broadening of access for the least developed countries to science and technology communities and to related research conducted worldwide. To be effective, a technology facilitation mechanism should address those issues in a practical, flexible and collaborative manner that involves all relevant stakeholders (see box 1).

Box 1

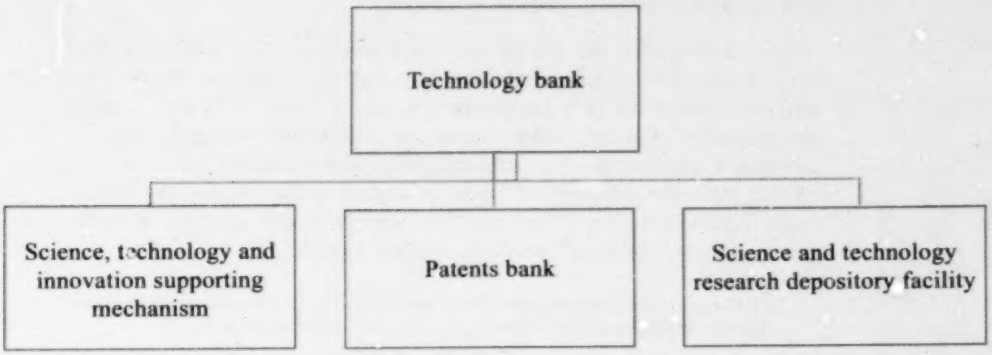
Success factors for the establishment of a technology facilitation mechanism for least developed countries

In a recent report, the Secretary-General outlined a number of success factors for a technology facilitation mechanism based on lessons learned so far (A/67/348). On that basis, the following factors appear particularly relevant for the establishment of a technology bank for the least developed countries:

- Address the technology gaps of the least developed countries throughout the full technology cycle, from research to development, demonstration, market formation and diffusion
- Foster a truly global, cooperative undertaking in support of least developed countries that engages all interested governments and major groups, including the private sector and academia
- Greatly improve technology transfer to the least developed countries, both North-South and South-South
- Pragmatically address intellectual property rights with a balanced approach towards safeguarding the interests of least developed countries and the technology holders, including by exploring innovative approaches
- Ensure the participation of the least developed countries in international networks of collaboration in research, development and demonstration
- Build partnerships to better coordinate and support the implementation of technology-related international commitments, agreements and conventions in favour of the least developed countries
- Exercise practicality and flexibility in order to quickly adjust to new challenges and opportunities.

24. A technology bank dedicated to the least developed countries could advance the goals of endogenous science, technology and innovation capacity-building and technology transfer in an integrated manner through: (a) a patents bank; (b) a science and technology depository facility; and (c) a science, technology and innovation supporting mechanism (see chart below). A blueprint of specific arrangements, which will require further consultations with key stakeholders, is not provided herein. Instead, the paragraphs below outline the rationale and broad functions of the components of the technology bank.

Proposed structure of the technology bank


Technology bank
Science, technology and innovation supporting mechanism
Patents bank
Science and technology research depository facility

A. Patents bank

Key considerations

25. Proponents of greater access to exclusive (that is, patented) intellectual property for the least developed countries have long advocated some sort of centralized technology consortiums or licensing mechanism that could secure relevant intellectual property at negotiated or concessionary rates for onward distribution to institutions and researchers in the least developed countries. For example, the United Nations Conference on Trade and Development (UNCTAD) advanced the idea of a technology licensing bank offering enterprises in least developed countries such licences at a subsidized cost, while paying fees to external firms at a market rate, with the difference to be borne by the Governments of the least developed countries, or donors, or jointly by both (see box 2).

Box 2
Facilitating technology licensing for firms in the least developed countries

UNCTAD has posited an innovative "technology licence bank ... acting as a licensing pool for technologies" with three broad functions: first, offering enterprises in least developed countries technology licences for use of the technologies in the pool at a subsidized cost to be borne by the Governments of those countries or by donor agencies, or by both jointly; second, providing a database of technologies and inventions, along with details of supplier firms, their relative merits and licensing costs; and third, acting as a clearing house for the licensed technologies, thereby reducing bargaining asymmetries between firms in developed countries and those in least developed countries.

To encourage firms in industrialized countries to participate in the technology licence bank, the licence bank would pay them fees at the market rate, in addition to committing to adhere to internationally agreed standards of protection of intellectual property rights. The participating industrialized countries could also be further incentivized through the

award of a label (similar to "fair trade labels" or ecolabelling) certifying that the enterprises are "pro-development", which could be used by the firms to gain goodwill from global markets.[a]

It is proposed that the patents bank function along the above lines, but it would differ from patent pooling in two key respects: first, it would provide licences not only for patented products, but also for products that are protected through other forms of intellectual property, thereby covering a wide range of sectors and firms; and second, it would not rely on the altruistic motives of firms in industrialized countries. Besides receiving fees, the firms that own the licences would also gain from the goodwill generated by a "pro-development" labelling.

[a] Alternatively, the patents bank could work with the Geneva-based International Standards Organization to develop a new certifiable standard.

Source: United Nations Conference on Trade and Development, The Least Developed Countries Report 2010: Towards a New International Development Architecture for LDCs, pp. 214-215, available from http://unctad.org/en/Docs/ldc2010_en.pdf.

26. In recent discussions, the International Intellectual Property Institute has also suggested that individual rights holders might license some intellectual property royalty free to a mechanism like the patents bank — assuming that such intellectual property could be protected and confined to use by least developed countries.[10] In that instance, the patents bank might facilitate hands-on technical assistance from the patent holders. Such support is desirable because most patents are difficult to employ effectively without access to the know-how and trade secrets behind them. The Institute expressed the belief that a significant number of multinational corporations might deposit patented technologies into such a repository and provide the requisite technical assistance if the licensing agreements would protect them from having the same intellectual property infiltrate the markets from which those companies derive their profits.

27. Such assistance ultimately could also benefit donor companies themselves — ranging from large corporations to small- and medium-sized enterprises — if the licences were drafted in such a way as to give the donors the benefit of improvements or derivative innovations when sold in their own existing markets. In such cases, the licences could provide a royalty to inventors in least developed countries for their improvements.[11] The patents bank could negotiate appropriate terms on behalf of inventors in least developed countries and provide marketing advice and services. The patents bank could also have a mechanism to arbitrate any dispute arising from the licensing arrangements under its auspices.

[10] Discussion with the Chairman/President of the International Intellectual Property Institute, Bruce Lehman, on 21 March 2013, during the course of preparation of inputs to the present report.

[11] An UNCTAD study on Bangladesh found that the local firms were not sufficiently specialized to protect their innovations. This is an area where the technology bank could provide tangible support (see United Nations Conference on Trade and Development, The Least Developed Countries Report 2007, available from http://unctad.org/en/Docs/ldc2007_en.pdf).

28. Such a win-win formula would enable researchers in least developed countries to modify patented technologies in order to address the particular needs of their own societies, where relatively few high-tech multinationals earn substantial profits outside the sectors of agricultural commodities and mineral extraction. Even when scientists in the least developed countries do invent something of global applicability, they generally lack the capacity and resources to patent, manufacture and market their inventions. Under this collaborative scenario, they could do so. Of course, the least developed countries would always retain licences to use the improved inventions within their own territories.

29. The patents bank could also solicit so-called "orphan patents", namely, intellectual property held by multinational corporations which they no longer commercialize but must still secure, lest it be exploited by competitors. In some countries, corporations can donate such intellectual property to universities and secure a modest tax deduction; but all benefit by not having to pay annual filing fees to various national patents authorities and the World Intellectual Property Organization.[12]

30. Scholars of intellectual property disagree by a wide margin on what percentages of patents have the actual potential to be commercialized, but most put the number quite low. Thus, a patents bank might have to sift out technologies from a massive database to help identify those that could have an obvious benefit to the least developed countries. In the absence of such a filter for appropriate technology, the least developed countries could be overwhelmed by patents and technologies that are at best marginal.

31. Still, a researcher or institution in a least developed country might find new applications for transferred intellectual property or identify local commercialization opportunities that never materialized when such intellectual property was patented in the developed world. In those instances, the patents bank could negotiate with the original patent holder on behalf of the least developed countries to monetize value thus added.

32. As the work of the patents bank would start to bear fruit, one also would expect original intellectual property to emerge from within the research ranks of the least developed countries themselves. The WIPO programme Access to Research for Development and Innovation, launched in 2009, includes innovative and comprehensive training modules for researchers in the developing world to commercialize and patent their research. The patents bank could also help researchers in least developed countries recognize and patent such intellectual property.[13] At the same time, the ramifications for intellectual property of a patents bank would need to be reconciled with the ongoing debate on the transfer of technology within the World Trade Organization, as discussed below.

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[12] In one noteworthy example, the Dow Chemical Company calculated that it had saved more than $40 million over five years (1996-2001) by donating over 10,000 patents to universities in the United States rather than continuing to pay filing fees to North American, European and Asian patent offices.

[13] The International Intellectual Property Institute, while recently examining articles published in science journals in a member State of the Association of Southeast Asian Nations, spotted numerous instances where principal investigators had failed to appreciate that they had generated patentable research.

Patents bank for the least developed countries and the World Trade Organization Agreement on Trade-Related Aspects of Intellectual Property Rights

33. The patents bank could help bridge a fundamental gap which the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS agreement) has failed to address via technology transfers.[14]

34. Article 66.2 of the TRIPS agreement, which was specifically formulated to help close science and technology gaps in the least developed countries, states that: "Developed country members shall provide incentives to enterprises and institutions in their territories for the purpose of promoting and encouraging technology transfer to least-developed country members in order to enable them to create a sound and viable technological base" (available from www.wto.org/english/tratop_e/trips_e/t_agm7_e.htm). Responding to critique from the least developed countries that this formal commitment was routinely ignored, the WTO Council for TRIPS enacted in 2003 an annual reporting requirement, with full updates required every three years.

35. Developed country members of WTO have complied, typically with listing of examples of their technology transfers. In 2012, the report of the Government of the United States numbered 35 pages, while the report of the European Union (covering major European donor governments) totalled 94 pages. Significantly, most reporting members note that their private sectors, not their governments, are the primary drivers of technology transfer. As was observed in a report of the European Union: "In their efforts to encourage and promote technology transfer, developed country governments are usually limited by two factors: (1) they do not own the vast majority of such technologies; (2) they cannot force the private sector to transfer its technologies. Incentives can therefore only take the form of encouragement, promotion and facilitation of projects which are part of a global and comprehensive approach to development.... Finally, it should be borne in mind that no technology transfer programme is specifically dedicated to least developed countries as such."

36. As those reports to WTO indicate, technology transfers to the least developed countries do occur through donor programmes, but such efforts are either incidental to specific country and regional projects or are part of a targeted technical objective (for example, clean water, combating AIDS and malaria, and eradicating crop pests, among others). While commendable, such efforts rarely constitute a coherent technology transfer plan or purpose, nor do they constitute more than a very small proportion of total development assistance.[15]

37. In large part, the initiative on behalf of a technology bank and science, technology and innovation mechanism for the least developed countries grew partly out of frustration that the promise of article 66.2 of the TRIPS agreement has not yet

[14] "Technology transfer" conveys two very different, widely used, and easily confused meanings. Among Western universities, technology transfer is a catch phrase for applied science, or "lab-to-market", as with an engineering school's business incubator. In the current context, however, it refers to the transmittal of advanced technical knowledge from developed countries to the developing world.

[15] The percentage of official development assistance applied to science, technology and innovation is inherently difficult to quantify. But, in The Least Developed Countries Report 2007, UNCTAD calculated that only 3 per cent went to research and advanced or specialized training during the period 2003-2005. A decade on, this percentage is almost certainly higher, but probably is still quite low.

been realized.[16] One would hope, therefore, that technology transfers under the technology bank initiative could attract additional official development assistance.

38. The technology bank for the least developed countries, especially its patents bank arm, must find a way to balance the technological needs of the least developed countries, on the one hand, and the legitimate interests of individual holders of intellectual property whose intellectual property is transferred through its aegis. This could be done by reconciling articles 66.1 and 66.2 of the TRIPS agreement. It should be noted that article 66.1 of the TRIPS agreement, which exempts the least developed countries from establishing an intellectual property protection regime, was due to expire on 1 July 2013.[17] Following intense consultations, WTO members agreed on 11 June 2013 to extend until 1 July 2021 the deadline for least developed countries to protect intellectual property under the WTO TRIPS agreement, with a further extension possible when the time comes (see http://www.wto.org/english/news_e/news13_e/trip_11jun13_e.htm).

39. A simple option to reconcile articles 66.1 and 66.2 of the TRIPS agreement might be for the technology bank to undertake to protect any intellectual property so transferred, working with participating least developed countries to establish a corresponding legal framework within their borders.[18] Effectively, this would suspend the blanket exemption of article 66.1 of the TRIPS agreement for the particular technology transferred under article 66.2 of the TRIPS agreement, as long as it passed through the patents bank. Thus, in committing to legally protect any intellectual property transferred under the patents bank, the participants from least developed countries would not compromise their more generic privileges under article 66.1 of the TRIPS agreement. They would safeguard only intellectual property that is deemed to be of genuine and direct value to themselves, without having to establish a comprehensive and costly intellectual property regime for the full panoply of trade-in-services.

40. A complete intellectual property rights system from the start would pose a monumental undertaking for most of the least developed countries, especially when the full benefits of intellectual property rights are so abstract or years in the making for most of their economies. Instead, they could construct a broader legal framework incrementally, growing as the benefits of homegrown intellectual property take hold. At the same time, a patents bank could hold a compensatory reserve fund for rights holders should its arbitration mechanism determine that transferred intellectual property had been misused. Participation in a patents bank, especially on the part of companies with high potential, would need to be encouraged by the development partners.

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[16] This debate has carried over to the World Intellectual Property Organization, as witnessed by recommendation 26 of the organization's development agenda, which seeks to encourage member States, especially developed countries, to urge their research and scientific institutions to enhance cooperation and exchange with research and development institutions in developing countries, especially the least developed countries.

[17] A separate World Trade Organization exemption concerning pharmaceuticals will expire on 1 January 2016.

[18] This is in line with the UNCTAD suggestion that a technology licensing mechanism for the least developed countries could commit "… to adhere to internationally agreed standards of intellectual property rights protection" (see UNCTAD, The Least Developed Countries Report 2010).

B. Science technology and innovation supporting mechanism

41. As the foregoing would suggest, a technology bank for the least developed countries should be much more than a passive repository of existing knowledge. While the technology bank's greatest and unique asset might be a patents bank, building a robust, endogenous science technology and innovation capacity in the least developed countries and mobilizing commensurate international support will necessitate placing a supporting mechanism within the technology bank.

42. The need for such a mechanism has been made acute by the internationalization of research and development requiring strong local capacity for acquisition and adaptation technologies. Moreover, scientific infrastructure and human capital are considered among the key factors in making technology licensing decisions.[19] The activities and services hosted by the mechanism will help remedy the deficiencies in the capacities of the least developed countries. Over time, those functions are expected to gradually diminish as the endogenous capacities of the least developed countries develop.

43. Support by academia and philanthropic foundations in the developed world can help advance science technology and innovation in the least developed countries. For instance, a number of multinational corporations have established philanthropic foundations that focus on the developing world and have a strong science and technology component, such as the Syngenta Foundation for Sustainable Agriculture (www.syngentafoundation.org) in Switzerland. Many industries and corporations in both developed and emerging developing countries devote considerable resources to research and development and could be interested in expanding their research to least developed countries. As noted above, many of the world's most pressing problems faced by the least developed countries lend themselves to scientific intervention (for example, agriculture, health and pharmaceuticals, sustainable energy or adaptation to and mitigation of climate change, among others) and are best studied in those countries. The science technology and innovation supporting mechanism could harness such opportunities in support of building effective science technology and innovation policies and institutions in least developed countries.

44. With many entities, including multiple agencies of the United Nations system, already operating in related arenas, the science technology and innovation supporting mechanism should avoid duplicating their efforts. But the participation of least developed countries in such efforts appears to be hit or miss. The science technology and innovation supporting mechanism could keep abreast of such initiatives, inform itself of relevant technical and capacity needs of least developed countries, and advocate for their inclusion in a more structured manner. Likewise, the mechanism could leverage donor government initiatives.

45. Material shortcomings are endemic to academic institutions in the least developed countries, but science and technology faculties are at a special disadvantage given the prohibitively high equipment and operating costs inherent to their disciplines. To address this, a coordinated approach would be needed to pool

[19] In the past many would have argued that research, development and demonstration would be of relatively little importance to poorer economies, but this is less and less the case, in view of the internationalization of research, development and demonstration and the need to bridge large technology gaps through local adaptation. See A/67/348.

financial resources and material support from both traditional donors and emerging contributors, as well as other stakeholders.[20]

46. Advanced economies are also home to large diaspora populations from the developing world, including those from least developed countries. While developmental economists have focused largely on the considerable consequences of their economic remittances, such expatriates also comprise a de facto diaspora knowledge network.[21] Considering that 30 to 50 per cent of developing world professionals trained in science and technology may live in the developed world,[22] the prospect of tapping into that network is alluring. This is especially so for those developing world expatriates holding advanced degrees, as they tend to emigrate at a much higher rate than university graduates in general.[23]

47. The science technology and innovation supporting mechanism could explore ways to best tap into this diaspora knowledge network, and perhaps pilot a few country programmes accordingly — with the caveat that creating effective diaspora conduits for knowledge transfer is more difficult than popular perceptions might suggest. For example, while a modest programme launched by France and Senegal has had some success, a United States-backed Caribbean Idea Marketplace initiative (including Haiti), launched in 2012, seems unlikely to continue for long.[24] A fundamental stumbling block is the lack of a comprehensive database for expatriates from the developing world qualified in science technology and innovation.

48. Nevertheless, the potential payoff from the standpoint of least developed countries is so great that some special effort seems warranted. Not only do least developed countries produce fewer professionals qualified in science technology and innovation than the developing world at large, their brain drain is much worse as well. Nearly twice as many professionals emigrate from the least developed countries (18.4 per cent) as from other developing countries (10 per cent).[21]

49. Beyond traditional North-South avenues, the science technology and innovation supporting mechanism should also encourage capacity-building through South-South cooperation. For example, the Oswaldo Cruz Foundation, the Brazilian health research institute (FIOCRUZ), is currently helping Mozambique to build and operate a modern pharmaceutical factory for retroviral drugs.[25] The mechanism

[20] For example, Seeding Labs, a non-governmental organization based in Boston, Massachusetts, collects, refurbishes and donates previously owned scientific equipment to developing country institutions, but the need is much greater than existing resources can supply (www.seedinglabs.org).

[21] UNCTAD, The Least Developed Countries Report 2012: Harnessing Remittances and Diaspora Knowledge to Build Productive Capacities, available from http://unctad.org/en/PublicationsLibrary/ldc2012_en.pdf.

[22] Lowell, Findlay and Stewart, "Brain strain: optimizing highly skilled migration from developing countries", Asylum and Migration Working Paper No. 3 (London, Institute for Public Policy Research, 2004).

[23] UNCTAD, The Least Developed Countries Report 2007: Knowledge, Technological Learning and Innovation for Development, available from http://unctad.org/en/Docs/ldc2007_en.pdf.

[24] See "Caribbean enterprise project struggles to involve diaspora", 4 April 2013, available from www.scidev.net.

[25] Brazil is also home to one of the world's most impressive metrological institutes, the National Institute of Metrology, Quality and Technology (INMETRO). Given that metrology (weights and measures) is foundational to global trade, one would hope that INMETRO might replicate the FIOCRUZ model among the several lusophone least developed countries.

could play a complementary role to more traditional donor coordination by informing least developed countries of diverse development initiatives that might prove germane to their situations.

50. More pragmatically, the mechanism could add genuine value through training and mentorship programmes to teach business and entrepreneurship skills to entities in the least developed countries (public and private) and to individual researchers. Researchers in least developed countries who might wish to market their science must learn how to prepare a business plan that will attract potential investors (see the website of Global Innovation through Science and Technology, http://gist.crdfglobal.org/gist-programs/business-plan-competition).

51. Institutionally, the mechanism could also advise and support universities in least developed countries in establishing business "incubators" on their campuses. While incubators are now a standard feature at virtually every technical university or engineering school in the Western world, they are absent from most institutions in least developed countries. As multidisciplinary teams define contemporary global research, a single university in a least developed country or even an individual country might lack commercial collaborators who otherwise could be available in neighbouring countries, as well as in institutions in the developed world.[26] Given resource constraints, there might be only one incubator per least developed country for which the mechanism could serve as a constitutive coordinator.

52. A major problem faced by universities in least developed countries is the lack of connectivity. As the Internet grew during the 1990s, the academic and research institutions that created it were among the first to chafe under its bandwidth limitations. Cutting edge science imposed ever increasing data demands. As a result, national research and education networks were spawned in the late 1990s and rolled out over the past decade. Such networks now envelop the developed world — Internet2 and CANARIE in North America, GÉANT in Europe, APAN and TEIN in Asia, and the Global Ring Network for Advanced Application Development, GLORIAD, encircling the northern hemisphere.

53. Meanwhile, scientists in the developing world are endeavouring to create their own national research and education networks, often with vital assistance from their counterparts in countries with advanced economies. Funded by the European Community, CÉANT has driven a dramatic roll-out of undersea fibre optics around Africa and to Asia. In general, however, connectivity in the developing world is far behind the capacity of the developed world.[27] In a recent paper examining the failure of African universities to generate intellectual property commensurate with their human resources, leading African national research and education network technologists posited that "... the current isolation of Africa-based researchers from the global information infrastructure is a major contributing factor, and that the

[26] The notion of incubators as engines of innovation has taken hold at many universities in advanced economies in the developing world, particularly among those hosting competitive electronics industries. Unfortunately, most such universities have rejected recommendations for a national incubator consortium, with the unfortunate effect that their accumulated knowledge is dissipated rather than reinforced.

[27] Worcester Polytechnic Institute, one of the smallest, but best equipped, engineering universities in the United States, maintains an active exchange programme with the Polytechnic of Namibia. The Institute found that it had more bandwidth on its campus than did the entire country of Namibia.

reduction of such isolation will lead to increased intellectual property output".[28] Most universities in least developed countries also face a serious challenge of campus "last kilometre" connectivity.

54. The mechanism can offer practical help to bridge this gap through partnerships with major national research and education networks. Two key national research and education network partners, Internet2 and the Network Startup Resource Centre at the University of Oregon, have indicated interest in joining forces with a science technology and innovation mechanism for least developed countries to align their activities for greater impact among these countries.[29]

55. Entrepreneurial research institutes or scientists do not necessarily have to establish their own ventures if they can market their research achievements to others. These could be local or regional investors. The very successful Israel-United States Binational Industrial Research and Development Foundation (www.birdf.com) (BIRD) commercializes local research and development by matching investment funds from interested American corporations, many of them major multinationals. Indian officials visited Jerusalem to study its operation, and subsequently created their own fund on the BIRD model. A similar but more modest venture capital fund for scientists in least developed countries could work well if it could secure initial seed capital. The science technology and innovation supporting mechanism could administer the fund and select the most viable candidates, just as the BIRD and Indian funds do today. It could also provide marketing assistance and advice to clients in least developed countries.

56. Problem solving need not necessarily imply monetary gain. The United States National Science Foundation, for example, has recently launched a new programme with the United States Agency for International Development to pair researchers from the United States and the developing world in order for them to collaborate on issues of common scientific interest, the Partnership for Enhanced Engagement in Research. Equally, vast amounts of scientific know-how exist as open-source knowledge or in the public domain of governmental research across the globe.

57. The science technology and innovation supporting mechanism would need to have a robust legal department with the ability to negotiate on behalf of participating institutions in least developed countries. Virtually every research agreement between universities in the developed world includes an intellectual property annex governing proportional ownership or distribution of new intellectual property that might be generated under their mutual collaboration. Researchers generally lack such legal resources and should expect no less support from the science technology and innovation supporting mechanism. This would ensure that scientists and technologists from least developed countries enter into only those agreements that protect and reward the parties equally, while ascertaining that all parties understand their shared privileges and responsibilities.

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[28] Tusubira and others, "The Impact of Improved Access and Connectivity on Intellectual Property Output: Baseline Report", available from http://www.ubuntunet.net/sites/ubuntunet.net/files/the_impact.pdf.

[29] Discussions with senior executives of Internet2 and Network Startup Resource Centre during the Internet2 annual conference on 21 and 22 April 2013 in the course of preparation of inputs to the present report.

C. Science and technology research depository facility

58. There are already examples of technology repositories serving science technology and innovation in the developing world (see box 3). For instance, Research4Life (www.research4life.org) is an innovative public-private partnership among four United Nations agencies (the World Health Organization (WHO), the Food and Agriculture Organization of the United Nations (FAO), the United Nations Environment Programme (UNEP) and WIPO), global publishers of online scientific and technical publications, and several technical partners, including Microsoft. This initiative offers a substantial framework that has expanded and worked well for over a decade. As such, it offers a unique opportunity for a science and technology research depository facility under the technology bank to extend the benefits of Research4Life well beyond the current partner United Nations agencies to include other multilateral development and technical agencies.

Box 3
Collaborative research depository facilities — Research4Life and its partnerships

First conceived by WHO in 2001, Research4Life had responded to a survey in 2000 of countries with average gross per capita incomes of $1,000 or less (just above the least developed country threshold today, and somewhat higher in 2000). Some 56 per cent of institutions surveyed had no current subscriptions to international journals. This lack of access to contemporary research in the life sciences was perceived as a systemic obstacle to better health delivery in the developing world.

Subsequent discussions with the International Association of Scientific, Technical and Medical Publishers led to the launch of the Health InterNetwork Access to Research Initiative in 2002. Today, the Initiative includes over 160 publishers and 5,300 public institutions in over 100 eligible countries.[a] A year later, in 2003, FAO launched Access to Global Online Research in Agriculture, which now includes over 70 publishers and over 2,200 institutions.[b]

In 2006, the UNEP launched Online Access to Research in the Environment, with more than 60 publishers and 2,300 institutions.[c] Most recently, in 2009, WIPO joined Research4Life with Access to Research for Development and Innovation (ARDI). It includes the most important searchable (and otherwise expensive) online patent listings in the developed world.[d]

[a] www.who.int/hinari/en/index.html.
[b] www.aginternetwork.org/en/.
[c] www.unep.org/oare/en/.
[d] www.wipo.int/ardi/en/.

59. Strategically, Research4Life's publishing partners include global giants such as Elsevier (Anglo-Dutch), Springer (German) and Wiley (American). Together, they provide access to more than 9,000 leading journals in the fields of health,

agriculture, environment and technology. Lesser known journals add a few thousand more. While English tends to be the lingua franca of global, peer reviewed scientific journals, Research4Life also includes periodicals published in several other languages. Nearly 50,000 e-books are currently accessible. Moreover, as the still nascent electronic publishing industry expands into scientific monographs, the number of pertinent e-books is expected to grow exponentially in coming years.

60 Access fees, calibrated on a sliding income scale, are kept remarkably low for all developing countries. The least developed countries, by virtue of their official status at the base of the global income hierarchy, automatically qualify for free access, as do several other developing nations whose income levels still remain low. Thus, eventual graduation from least developed country status is unlikely to have an impact on free access for years afterwards, and even then would involve only a marginal annual fee.

61. To grasp the size of this benefit, one must understand that some very specialized science journals command subscription fees of up to $20,000 annually. Using an average annual subscription fee of $1,700, WHO calculates that every researcher in the least developed countries could access approximately $10 million worth of subscription medical journals annually through their affiliated not-for-profit institutions. That is likely a conservative estimate; the true value could be much higher. Elsevier, for example, reckons that its own data-mining apparatus routinely scans some 20,000 journals and proceedings, yielding around 4 million citations annually. All are available to participants in Research4Life. Moreover, Elsevier has developed a proprietary search engine, Scopus, whose thematically driven algorithms dramatically reduce extraneous search results gleaned from scientific literature. Scopus is available at no charge for least developed countries via Research4Life, and Elsevier has indicated it would give positive consideration to the use of Scopus by a technology bank for the least developed countries on behalf of qualifying institutions in those countries.[30]

62. Beyond staying abreast of leading-edge research, Research4Life empowers LDC scholars who might wish to publish their own research. Peer reviewed journals typically require copious citations of other contemporary research to establish an author's academic credentials, and Research4Life ensures that scholars in least developed countries can remain up to date and knowledgeable in their chosen fields. By studying the published work of those pursuing parallel or complementary research, scholars from least developed countries can also discover and locate potential collaborators anywhere in the world.

63. Nearly every least developed country has at least a few world-class scientists, or at least academics with that potential. However, they are almost never sufficiently numerous in the same discipline and would probably still lack "critical mass" if they were. The research depository facility could help bridge this gap, offering the potential for science and technology investigators in least developed countries to join global research teams "virtually". Given that many of the most urgent global issues (for example, climate change and sustainable energy) are best studied in the developing world, one might assume that researchers in many of the world's top research universities would welcome an overture from their counterparts in least

[30] Discussion with Dr. Alicia Wise, Director of Universal Access of Elsevier, on 20 March 2013 in the course of preparation of inputs to the present report.

developed countries. The research depository facility could also help broker collaborations with institutions in countries with advanced economies (North-South), across the developing world (South-South) and act as a global facilitator for them all (triangular cooperation).

64. The research depository facility could usefully employ a cadre of technology bank librarians to assist scholars in least developed countries in their research. While this function in the developed world has been largely subsumed by the ability of individual scholars to conduct their own online research, it could well serve those in least developed countries. Academics in least developed countries routinely carry teaching loads that would be regarded as crushing by their peers in the developed world, which constrict the time available to conduct research. Likewise, limited access to high-bandwidth networks and powerful computer terminals poses practical constraints that could be overcome with the assistance of external librarians working with the technology bank.

65. Technology bank librarians could also help locate the most relevant online journals that might welcome submissions from scholars in least developed countries. Likewise, given that writing for peer reviewed journals is an acquired skill, technology bank staff could conduct online training (distance learning) in how to write for scientific audiences and how to get such material published. A parallel communication skill is how to structure and draft compelling narratives for grant proposals.[31]

66. At the same time, cross-disciplinary collaboration has become a hallmark of cutting edge research in advanced economies. For those researchers in the least developed countries who are globally competitive, however, the obstacle might not be academic silos at their own institutions. Comparable capabilities in complementary disciplines might not even exist on their campuses.[32] Technology bank librarians could help such researchers connect with cross-disciplinary scholars in other countries, North and South. Equally, the research depository facility could vet those online journals which might solicit articles from researchers in least developed countries. Unfortunately, there has been a rise of spurious electronic "peer reviewed" journals that target unsuspecting scholars in the developing world.

67. It will be important for the research depository facility to address some of the apparent limitations of Research4Life. Despite the latter's enormous promise, relatively few researchers outside those in contact with its four United Nations partner agencies appear to have heard of it. Significantly, Research4Life has not been established or funded to staff and equip a full-time secretariat which might otherwise play the role of coordination and outreach. Without encroaching on the good work undertaken by the current four agencies, the research depository facility could serve that function, at least insofar as it concerns least developed countries.

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[31] Most top research universities in Europe and North America conduct courses in writing grant proposals for their faculties. Overburdened academics in least developed countries, even if they learn now, would still be challenged to find time for the grant application process. A technology bank and science technology and innovation mechanism could help them narrow the search for promising and otherwise overlooked funding streams and critique their applications before submission.

[32] Conversely, smaller institutions in least developed countries may be less prone to the exclusion and intellectual inbreeding which still pervades many top research faculties in advanced economies.

Currently, Research4Life operates on the basis that an inquisitive researcher will seek out information on a repetitive but single-query basis. The research depository facility could develop a "push" as well as "pull" capacity, much as online media services transmit periodic (daily, weekly or monthly) computer-generated newsfeeds based on the declared interests of individual subscribers.

68. More critically, the potential of Research4Life has been limited by the difficulty to effectively access and exploit it. Beyond the technical issue of network connectivity, Research4Life has never been funded to provide training to the scholars in the developing world for whom it is intended. WIPO, for its part, has developed targeted short courses (two to three days) designed to maximize access to ARDI, its Research4Life component, but financing is limited. Because ARDI emphasizes both research and development, it is explicitly geared towards innovation and protecting the intellectual property so generated. The research depository facility could employ ARDI training modules to dramatically expand the development potential of Research4Life across the full range of science and technology among the least developed countries.

69. In addition to online technical journals and proceedings, a vast array of technical reports is increasingly available and searchable from government labs themselves. The United Kingdom of Great Britain and Northern Ireland and the United States are leading, but this trend is spreading to other countries and rapidly expanding a deep pool of accessible science and technology research.[33] The research depository facility could mine such information to locate promising partnerships for the least developed countries with government labs in countries with advanced economies, as well as with counterpart institutions funded by those governments' research grants.

V. Organizational aspects: some preliminary considerations

70. Thanks to the generosity of the Government of Turkey, a technology bank dedicated to the least developed countries is assured a strong start, which would attract strong contributions from the North and emerging economies. As noted above, finalization of the arrangements as regards organization, functions, governance structure, funding and staffing will require wide-ranging consultations with key stakeholders. Some preliminary considerations as regards governance, funding and stakeholder partnerships are noted below.

71. It is also noted that the impact of the work of the technology bank in regard to helping develop endogenous scientific and technical capacities, as well as the facilitating transfer and dissemination of new technologies on the development of the least developed countries, can be greatly increased if they are accompanied by domestic regulatory reforms that also encourage domestic private sector development, appropriate protection of intellectual property rights, and economy-wide technical upgrades.

[33] Research Councils UK and the United States National Academy of Sciences have been proactive in moving research to "open access". The National Academy of Sciences now makes all of its funded research available online at no charge (www.nasonline.org), and the Research Councils UK expanded its already exemplary open access policy in April 2013 (www.rcuk.ac.uk/documents/documents/RCUKOpenAccessPolicy.pdf).

A. Governance

72. The governing structure of the technology bank will depend on the nature of the organization. In the Istanbul Declaration, the generous offer of the Government of Turkey indicated that it would be an international centre. It would be best to develop a governance structure for the technology bank on the basis of existing institutional templates instead of reinventing the wheel.

73. In a recent report of the Secretary-General to the General Assembly, a United Nations affiliation for a technology facilitation mechanism was considered necessary to ensure global coordination.[3] In such an event, the governance structure of the United Nations Global Compact could provide useful guidance (http://www.unglobalcompact.org). The Global Compact has demonstrated that Governments, the private sectors of both North and South, and civil society can together advance a set of common goals. Because most global science and technology/research and development is generated by the private sector, a multi-stakeholder approach and United Nations branding similar to that of the Global Compact is likely to bolster the credibility and effectiveness of the technology bank.

74. The role of the host country, the least developed countries, the key contributors and the Office of the High Representative for the Least Developed Countries, Landlocked Developing Countries and Small Island Developing States would be critical in pulling together all the stakeholders to achieve the desired goals, and as such they are expected to take the lead in the governance process of the technology bank.

B. Funding

75. Just as the development community has embraced the notion of aid for trade, so could it consider supporting the concept of aid for science and technology, especially as it concerns the least developed countries. This should be in addition to the official development assistance already provided to the least developed countries. As noted above, the initiative of the technology bank for the least developed countries arose partly from frustration that the promise under article 66.2 of the TRIPS agreement has not been realized.

76. The technology bank is likely to benefit most from a multi-donor trust fund, supported by traditional donors as well as emerging economies, regional development banks and other multilateral agencies. Assuming that the host country would also bear a part of funding, other donor governments should be invited to share the cost, especially those who share the view that a tailored initiative that is specific to least developed countries is necessary to ensure that those countries can benefit from the same attention to science technology and innovation that has accelerated economic progress among more advanced developing economies. Donors could consider funding a concessional finance and investment scheme for start-up ventures that are oriented towards science technology and innovation. This could be undertaken in concert with existing development banks in accordance with their standard management practices, but tailored to the circumstances of the least developed countries.

C. Collaboration with stakeholders and partnerships

77. Since technological development is a complex phenomenon characterized by the interaction of a plethora of actors that range from businesses and universities to public institutions, among others, the technology bank could contribute to combining two key dimensions of successful structural change: technological progress, and productive capacity development. It could enter into partnerships with initiatives carried by other international institutions, such as multilateral and national development banks, international agencies, national development agencies, and others.

78. The technology bank could leverage existing international initiatives. For example, the new United Nations Framework Convention on Climate Change/UNEP technology transfer mechanism disburses no funds itself, but helps worthy projects draw against the Global Environment Facility and the Green Climate Fund. The technology bank could, for instance, help the governments and institutions of the least developed countries identify and draft competitive proposals for consideration by the technology transfer mechanism. Likewise, given that the technology bank would seek to better equip the least developed countries to compete in global trade, it could help its clients identify relevant science technology and innovation project proposals that are currently absent from the enhanced integrated framework. The technology bank could also take into the funding streams that are available globally for life sciences, agricultural research, and sustainable energy, all fields of immediate and pressing interest to the least developed countries.

79. The technology bank can emulate the Global Compact's philanthropic foundation to facilitate partnerships with those global and regional foundations and other private entities from North and South who might share its aspirations and objectives. Similarly, as the technology bank seeks to generate more robust science technology and innovation to prime multinational and regional investment interests in the least developed countries, a public-private partnership could be structured to welcome business engagement, whether as a form of global corporate citizenship[34] or as an allied venture capital instrument.

80. In the area of global corporate citizenship, the technology bank could work with bodies such as the International Standards Organization to develop a system of recognition of corporate support to technology transfer to the least developed countries through, for example, "pro-development" labelling.

VI. The way forward

81. The present report attempts to outline the broad structure and functions of the technology bank. Further consultations, serviced by the Office of the High Representative for the Least Developed Countries, Landlocked Developing Countries and Small Island Developing States, are needed to define its structure, functions, governance mechanism, funding and staffing arrangements, and other relevant institutional matters. Those consultations should involve a pool of experts drawn

[34] As noted above by way of example, a number of leading corporations, directly or through foundations established by them, as well as publishing houses, have contributed to science technology and innovation in the developing world.

from the host country, the least developed countries and other interested governments, agencies of the United Nations system, as well as other stakeholders, in order to work out institutional details, with a view to achieving an operational technology bank at an early date.